I. Project Title: **Humpback chub population estimate in Cataract Canyon, Colorado River, Utah.**

II. Principal Investigators:
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III. Project Summary:

The RIP recently identified recovery goals for the endangered humpback chub (*Gila cypha*). Recovery goals are based in part on maintaining populations of humpback chub in several locations, among which is the Cataract canyon population on the Colorado River. Identifying, maintaining, and monitoring a population necessitates obtaining accurate population estimates.

Objectives:

1. To obtain a population estimate of late juvenile/adult humpback chub in Cataract Canyon.

2. To identify if a relationship exists between ISMP catch rates and population size.

This project was initially scheduled to begin in 2002. However, due to record low flows that year, the beginning was delayed until fall 2003. In 2005 three sampling trips were conducted within Cataract Canyon between late September and October. Sampling

occurred in three primary sites which were identified as trend sites for long-term monitoring (RM 212-211, RM 208-207, RM 207-205). Due to low flows, the trend site at RM 207-205 was moved to RM 210 in both 2003 , 2004, and 2005. One additional site below the "big drops", Waterhole Canyon RM 198, was sampled in 2005 to see if newly available habitat was being utilized by endangered fish.

A total of 23 individual humpback chub and 5 individual bonytail chub (*Gila elegans*) were collected in Cataract Canyon by trammel netting. All chubs were captured using trammel nets. Five humpback chub were recaptured between trips and a total of four marked in 2003, and 2004 were recaptured. These data were used to estimate both cayon wide and section population estimates for humpback chub within Cataract Canyon.

IV. Study Schedule:

a. Initial year: 2003
b. Final year: 2005

V. Relationship to RIPRAP:

General Recovery Program Support Action Plan
V.A.1. Conduct standardized monitoring program.

VI. Accomplishments of FY05 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Goals:

1. Estimate the Cataract Canyon humpback chub population with confidence intervals as tight as possible.

2. Transport presumed wild bonytail to a hatchery.

Three sampling trips were conducted in Cataract canyon Between September 23 and October 29. Flows during sampling ranged from approximately 10,000 to 6,500 cfs. Daily mean water temperature ranged from 21 ^{o} C to 13 ^{o} C. Sampling occurred in three primary sites which were identified as trend sites for long-term monitoring (RM 211.5-211, RM 210-209.5, and RM 208-207). An additional site at RM 198 was sampled during the second pass.

Humpbacks*:* A total of 31 humpback chub captures were recorded during 1,375 hours of trammel netting, yielding a total catch rate of 0.022 fish/net hr (Table 1). No humpback chub were collected during 8.2 hours of electrofishing. Overall, 23 unique individuals were captured with a mean total length of 229.7 mm (range 195-255 mm TL, Figure 1). Only one humpback chub captured was a sub-adults (<200 mm TL). A significant decline in the number of individuals over 250 mm has occurred each year since 2003, with no fish over 260 mm occurring in 2005 (Figure 1.). No Humpbacks were captured below the "big drops".

A population estimate was calculated for humpback chub using program CAPTURE within the program MARK. The model selection procedure within CAPTURE was used to select an appropriate estimator. The null model (M_o) was selected by the program, this selection is supported by lack of any significant difference in catch rates between trips (Table 1). The estimate was calculated using 23 individuals and 5 recaptures between trips in all sites combined. The provisional 2005 point population estimate for humpback chub in Cataract Canyon is 66 individuals (p-hat= 0.167, C.V.= 0.34) with a profile of likely hood of 39 - 158 individuals.

As discussed in the past two annual reports, the question of fish not mixing between sites within a year arose again. Examination of all 2003-2005 recapture data showed that for 13 individuals recaptured between trips, 4 individuals recaptured after 1 year, and 2 individuals recaptured after 2 years, the maximum movement was less than 300 meters and all recaptures occurred in their original habitat complex (i.e. the large eddy pool complex below rapid #2).

Sectional density estimates were calculated using the 2005 data in two different sites (RM 210-209.5 and RM 208-207). The null model (M_o) was selected by program Capture for both estimates. The RM 210-209.5 site estimate was calculated using 17 individuals and 4 recaptures between trips. The RM 210-209.5 site point population estimate for humpback chub is 46 individuals (p-hat= 0.180, C.V.= 0.38) with a profile of likely hood of 27 - 126 individuals, this equates to a density estimate of 92 fish/mile. The RM 208-2075 site estimate was calculated using 3 individuals and 1 recapture between trips. The RM 208-207 site point population estimate for humpback chub is 6 individuals (p-hat= 0.299, C.V.= 0.5) with a profile of likely hood of 4 - 65 individuals, this equates to a density estimate of 6 fish/mile. In 2005 only two humpback were captured in the RM 211-211.5 site, this would equate to a minimum density of 4 fish/mile. Assuming that all available habitat above the big drops (7 RM) has a minimum density of 5 fish/mile (excluding RM 210-209.5), the cumulative population estimate would be 77 individuals in 2005. In 2004 and 2003 captures of humpbacks were more evenly distributed between sites, producing cumulative estimates of 285-550 humpback in the canyon.

Bonytails*:* A total of 5 bonytail chub captures were recorded during 1,375 hours of trammel netting, yielding a total catch rate of 0.004 fish/net hr (Table 1). No bonytail chub were collected during 8.2 hours of electrofishing. Overall, 5 unique individuals were captured with a mean total length of 278.2 mm (range 251-300 mm TL). None of the bonytail chub captured were sub-adults (<200 mm TL); and none were captured below the "big drops".

Overall Catch: A total of 303 fish, consisting of nine species were captured in Cataract Canyon. All four main-stem endangered were present and combined represented 15 % of the total catch. Humpback chub were the most common native fish present in our samples. Channel catfish were the most abundant species overall. Catch rates during trip 1 were likely decreased due to monsoon flows and heavy debris loads in the nets (Table 1).

Discussion: The 2005 estimate for all sites combined is very similar to the 2004 estimate, and, in terms of individuals captured and recaptures, similar to the 2003 estimate (Table 2).

It would appear that the number of humpback chub within Cataract Canyon has been relatively stable over the last three years and CPUE rates agree with this general statement as well. Our estimate of the actual number of individual in the canyon, however, does not meet the assumptions of our estimate model. Specifically, chubs within specific sites do not mix with chubs in other sites, therefore our estimates likely relate only to the number of fish in our three sample sites.

The option of examining the estimates as sectional densities within large-scale habitats (ie. a large eddy complex) was discussed in the 2003 annual report. The basis for this idea was that humpbacks were not moving during the sample period and thus the assumption of mixing within the canyon was not met. This idea was further supported by our limited recapture data, in both 2003 and 2004 all recaptures occurred within the same large-scale habitat units. In addition, the two humpbacks recaptured from 2003 sampling had not moved from their original large-scale habitats. If the 2003 and 2004 point estimates were viewed as sectional densities (40-85 fish/mile) and then extrapolated over the available habitat above the "big drops" (approx. 7 river miles) the population estimate for the canyon would be 280-595 humpbacks within Cataract Canyon. This is a rough approximation for discussion sake. The point being that if we find no movement of recaptures over a 3 year time frame it should be clear that mixing within the entire canyon is not occurring during our sampling periods and the population estimates would only relate to the actual sections sampled.

An ongoing concern for this population is the lack of juvenile humpbacks in our samples. It is unclear if we are ineffective in sampling them; or if that part of the life history cycle is suffering in this canyon. Seeing that the population has apparently persisted at or near current levels it is probable that our methods are not effective for collecting juveniles. Given the potential effects of a 5+ year drought and the presence of adult bonytail chub, we believe that completion of the three year estimate will provide a much needed insight into the biological value of Cataract Canyon.

Table 1. Trammel net effort and catch rates for humpback and bonytail for all sites combined, Cataract canyon 2004.

Trip #	Effort (net hrs)	# HB Captures	HB CPUE (fish/net hr)	# BT Captures	BT CPUE (fish/net hr)
1	446.05	5	0.011	2	0.004
2	472.63	15	0.032	0	0.000
3	456.50	11	0.024	3	0.006
Total	**1375.18**	**31**	**0.022**	**5**	**0.003**

Table 2. Humpback chub population estimates and related statistics for Cataract Canyon 2003-2005. All estimates represent the null model (Mo).

YEAR	INDIVIDUALS	RECAPS	POP EST	P-hat	C.V.	PROF. LIKELYHOOD	CPUE
2003	32	3	150	0.08	0.50	71-407	0.022
2004	28	4	72	0.15	0.37	39-160	0.035
2005	23	5	66	0.17	0.34	39-158	0.022

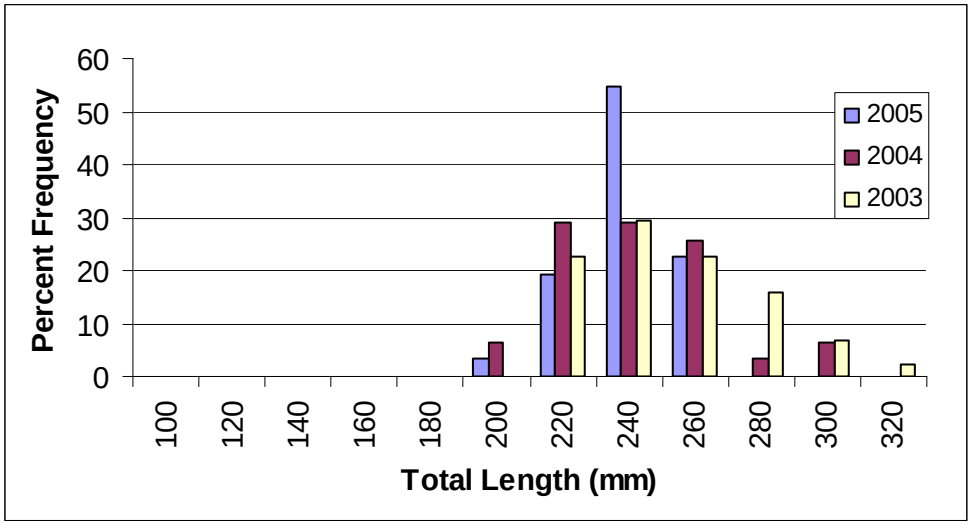

Figure 1. Percent frequency of total length distribution for humpback chub captured via trammel netting in Cataract Canyon 2003-2005.

VII. Recommendations:

- Due to low numbers of individuals, the three-pass mark recapture estimates in Cataract Canyon should not be further pursued.
- Persistent occurrence of bonytail and humpback chub warrants continued monitoring of distribution and relative abundance via a single sampling pass.
- Future monitoring should continue to be conducted in the fall and follow the 3-on-2-off sampling regime set for other upper basin canyons.
- Future monitoring should employ trammel nets as the primary sampling tool.

III. Project Status: Complete

Third year of three for project completed.

IX. FY04 Budget:

A. Funds budgeted:	$ 73,099
B. Funds expended/obligated:	$ 73,099
C. Difference:	$ 0
D. Percent FY2004 work completed:	100%
E. Recovery Program funds spent for publication charges:	$ 0

X. Status of data submission:

Data will be entered on the computer and transferred to USFWS by January 15, 2006.

XI. Signed: Paul Badame Date: 11/22/2005